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ABSTRACT

The amount and quality of financial aid received by approximately 100 men and women students who participated in a survey conducted by the American Association for the Advancement of Science is examined. The people responding to the survey questionnaire finished their PhDs after 1971. Major findings indicate that scholarships and family contributions were the two major sources of funding for students while attending college. Secondarily, students relied on their own earnings, loans, or spouse's earnings for additional funds. A trend of increasing support expected from the student is noted. According to the American College Testing Program, married male students in both 1959 and 1969 earned approximately 31/2 times as much as married female students, a difference of $2,000 per year, and unmarried male students earned approximately twice as much (about $500) as female students. At the graduate level it was found that science students switch from dependency on their parents and their own earnings to almost exclusive dependence on fellowships, research assistantships, or teaching assistantships to finance their education. (SPG)

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ON THE FINANCIAL AIDS RECEIVED BY SURVEY PARTICIPANTS DURING UNDERGRADUATE, GRADUATE, AND POSTDOCTORAL EDUCATION

by

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Symposium on the Participation of Women and Men in Scientific Research. Paper to be presented February 1978 for the American Association for the Advancement of Science.

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ON THE FINANCIAL AIDS RECEIVED BY SURVEY PARTICIPANTS DURING UNDERGRADUATE, GRADUATE, AND POSTDOCTORAL EDUCATION

Careers in science, more so than in most fields, generally require massive support for education, for equipment, supplies and training expenses. The federal government, private foundations, state governments, and the universities have all provided funds to facilitate the teaching of science in the past 25 years. Much has been written about the aggregate costs of scientific endeavors and of science education. In this report, however, I would like to focus on individual students; we will examine the amount and quality of aid received by approximately 100 men and women students who participated in the survey conducted by the American Association for the Advancement of Science; this survey was part of a larger study preceding the Conference on Women in Scientific Research held from 17-20 October, 1977. The people responding to the survey questionnaire finished their Ph.Ds after 1971, and thus the majority of them were undergraduates during the sixties when funding in science, as a percentage of gross national product, reached a peak; these students were in graduate school from the late sixties through early seventies when science funding was reduced by inflation and lower appropriations in some fields. Most of the participants in the survey have had postdoctoral experience and now are just embarking on their independent careers.

The major questions to be addressed in this presentation for the undergraduate years are:

1. Did male and female undergraduate students receive support from the same sources?

2. Did these students perceive financial problems as a major consideration in pursuing their education?
3. To what extent did federal monies support undergraduate science education as reflected in the experiences of the survey participants?
4. How do policy recommendations from conference participants bear on undergraduate financial problems?

The major questions for the graduate years are:

1. Did male and female graduate students receive support from the same sources and to the same extent?
2. Did these students perceive financial problems as a major consideraton during graduate school?
3. To what extent did federal monies support the graduate education of the survey participants?
4. What policy recommendations did participants have?

The data from the essays and questionnaires submitted by the male and female participants are extensive--the analysis of the raw data is still underway. Consequently, in this presentation I would like to share with you the major findings with the understanding that many details are left for further analysis. An additional problem is that participants represented all fields of science; and, as we all know, the funding situation in each discipline has varied during the last decade. To some extent the availability of student research assistantships, fellowships, and monies for attending scientific conferences follows the trends evident in each discipline; however, no attempt has been made to separate the participants by field of interest.

The American College Testing Program has reported recently on the sources of student support for undergraduate education. For a typical student family contributions or scholarship aid combined with loans and student job earnings are the major sources of funds for attending college. Most parents assume that they will make some contribution to college expenses for their children, and current college loan and scholarship policies in fact require contributions proportionate to income from family resources. Table 1 shows the major sources of support for the survey participants, which in microcosm bear out the A.C.T. report findings on sources of support for college education.

(TABLE I)

From this Table it is clear that scholarships and family contributions were the two major sources of funding for students while attending college. Men were no more likely to receive scholarships despite past practices of only offering athletic scholarships to male students. Family contributions were the major source of funds for men and women. Secondarily, students relied on their own earnings, loans, or spouse's earnings for additional funds. The availability of student loans, primarily through college guaranteed bank loans or federal supported student loan programs, to both men and women students has not been investigated in this report. However, no survey participants complained of difficulty in receiving loans when in need, and I think we should assume that loans were generally available to all students. Spouse's earnings were a minor source of funds to the male students in this survey since only a few of them were married during college.

TABLE 1 SOURCES OF FINANCIAL AID FOR UNDERGRADUATE EDUCATION

1 = most important source 4 = least important, but still a source

MEN = 43 WOMEN = 40

SCHOLARSHIP

	MEN	WOMEN
1	12	11
2	5	12
3	5	4
4	3	0

FAMILY CONTRIBUTIONS

	MEN	WOMEN
1	24	21
2	8	8
3	7	4
4	1	1

OWN EARNINGS

	MEN	WOMEN
1	4	6
2	26	18
3	6	4
4	1	2

SPOUSE'S EARNINGS

	MEN	WOMEN
1	1	3
2	2	3
3	1	0
4	0	1

LOANS

	MEN	WOMEN
1	3	1
2	5	5
3	6	2
4	0	0

A major source of supplementary funds for male undergraduates are summer and academic year jobs. According to the American College Testing report approximately 90% of all male undergraduates in 1960 and 1970 worked at some time during the year; among single, full-time women students, about 70% in 1960 and 75% in 1970 held jobs during the year; for married women students about two-thirds reported some earnings. Consequently, a higher proportion of male than female students work to earn money for college. in this survey

About 15% of the women participants earn money for college as their primary source of funds.
The proportion of college expenses met by student contributions in general is gradually rising. In 1960 male undergraduates earned about one-third of their annual expenses, but by 1970 they earned 44% of their expenses as shown in Table 2. (labelled A on slide). The increase in contributed earnings by female undergraduates is even more dramatic: in 1960 women earned 16% of their annual expenses and close to 33% in 1970--about double the earnings of a decade before. The participants in the A.A.A.S. survey were undergraduates in the mid-sixties when the changeover from primary dependence on family and school support was shifting toward a heavier contribution from the student. In 1960 student earnings constituted 23% of their college expenses; by 1969-70 student earnings paid for 40% of college expenses as shown in Table 3 (labelled Table 1 on slide). Of course, tuition and living expenses also rose dramatically during the sixties, but clearly the burden of support for a college education shifted somewhat from the family and school to the individual student.

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TABLE 1

Undergraduate Student Earnings Used to Finance Educational Expense

		Current Dollars per Student		
	Percent of Outlay Financed by Total Earnings	Contribution from Total Earnings	Contribution from Summer Earnings	Average Expense
1952	28	$ 385	$137	$1,388
1960	23	360	n.a.	1,550
1969-70	40*	1,003	610*	2,485
1971-72	30	793	428	2,615

*Includes total summer earnings.

Sources. 1952: Ernest V. Hollis and Associates, *Costs of Attending College*, Bulletin 1959, No. 9, U.S. Department of Health, Education, and Welfare, Office of Education (Washington: Government Printing Office, 1962), Table 8, p. 48.

1960: John B. Lansing, Thomas Lorimer, and Chikashi Moriguchi, *How People Pay for College* (Ann Arbor: The University of Michigan, Survey Research Center, 1960).

1969-70: Elizabeth W. Haven and Dwight H. Horch, *How College Students Finance Their Education: A National Survey of the Educational Interests, Aspirations, and Finances of College Sophomores in 1960-70* (Princeton, N.J.: College Scholarship Service of the College Entrance Examination Board, 1972), pp. 14, 15, 18.

1971-72: W. W. McMahon and A. P. Wagner, *A Study of the College Investment Decision*, Research Report No. 59 (Iowa City, Iowa: The American College Testing Program, 1973), and unpublished tabulations.

TABLE 3

TABLE 2 IN TEXT

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TABLE A

Statistical Highlights of the Study

Average Earnings

	1959			1969		
	Male	Female	Total	Male	Female	Total
Married	$1,867	$515	$1,327	$2,885	$899	$1,834
Other Marital Status	802	378	623	1,259	738	1,021
Commuter	784	426	645	1,247	783	1,041
Resident	814	351	610	1,279	705	1,006
Total	922	393	714	1,441	761	1,128

Percent of Annualized Costs Covered by Student Earnings

	1960			1970		
	Male	Female	Total	Male	Female	Total
Married	31.7	8.0	21.6	40.1	8.3	19.8
Other Marital Status	37.6	19.7	30.5	45.0	32.2	39.5
Commuter	43.1	29.6	38.4	51.0	41.2	46.5
Resident	34.7	16.0	26.8	40.9	25.1	34.7
Total	36.0	16.4	28.7	43.7	30.0	37.9

Distribution of Full-Time Undergraduates by Marital Status and Residence (percent of total)

	1960			1970		
	Male	Female	Total	Male	Female	Total
Married	11.3	10.5	11.0	11.2	14.3	12.6
Other Marital Status	88.7	89.5	89.0	88.8	85.7	87.4
Commuter	36.0	31.7	34.3	41.5	37.5	39.9
Resident	52.7	57.8	54.7	47.3	48.2	47.5

Considering this trend of increasing support expected from the student, it is instructive to examine the ability of male and female undergraduates to contribute to their own educational expenses. Again from the ACT report we learn that the amount of money earned by male and female undergraduates is not the same as shown in Table 2.

(Repeat Table 2)

Married male students in both 1959 and 1969 earned approximately 3½ times as much as married female students, a difference of $2,000 per year. Married male students are about 11% of the student population and married female students were 10.5% of the student population in 1959 and 14.3% of the student population in 1970. Non-married students actually contribute less toward their educaton than do married students. Unmarried male students earn approximately twice as much as about $500, as female students; a ratio that holds for students who reside at school or commute from home. The discrepancy in students earnings--amounting to $500 to $2,000 per year--is the major sex related difference in funding support for undergraduate education. Other factors of student support such as loans, required family contributions, and scholarship aid seem to be distributed with less sex bias. Some loan programs attempt to equalize student earnings potential in order to scale loans to need; however, this system can be abused as students underestimate earnings from unreported income. In order to equalize the amount of funds available to all students, the differential in base pay for typical student jobs held by male and female students must be abolished. On my own campus, Washington University, apparently some student service organizations have had male student

"managers" earning considerably more than female student "employees"--such situations may be fairly common on campus, the one work site in which it would seem relatively easy to correct salary discrimination.

The primary reason for dwelling at length on undergraduate sources of support for college education, was to lay a base for discussing the recommendations of the participants on the Conference on Women in Scientific Research. Many of the recommendations of the participants for implementation at the undergraduate level concern increasing the number of summer science programs and other research opportunities available to students. However, if students are pressed to earn upwards of 40% or more of their college education expenses, the choice between an interesting but low paying research job and a more lucrative job may be a tough decision even for a highly motivated person. If the goal of NSF sponsored summer science programs and other federally sponsored science education related programs is to increase the motivation of target groups such as women and minority students, the financial impact of participation will have to be examined very closely. Financial support for these worthwhile programs may have to be considerably increased to provide both student living expenses as well as an "income" for the following academic year. Average summer earnings ear-marked for educational expenses in 1970 were $610--this figure fell somewhat in 1971-72 to about $500 due to the inability of many students to find employment and expected income can be considerably higher than actual. The message is clear, students expect and are expected to save money during the summer for college expenses. A successful research program will have to fulfill a role as college financing source as well.

To insure participation in research opportunities programs, the sponsoring agency will have to determine how much students should be paid to participate so that sufficient funds will be "earned" for college expenses.

GRADUATE SCHOOL

At the graduate level, science students switch from dependency on their parents and their own earnings to almost exclusive dependence on fellowships, research assistantships, or teaching assistantships to finance their education. As shown in Figure 1 both male and female students depended on these three sources of support with only minor contributions from loans, family, spouses or their own earnings. Figure 1 shows that both the women who participated in the Conference plus 50 volunteers who provided questionnaires and essays for analysis have similar patterns of funding support during graduate school. Fellowships, TA and RA positions dominate the funding picture--these results were obtained by plotting responses of "1" and "2" that is, only majore sources of support were considered. In the second half of Figure 1 illustrating the sources of support for male students there are only a few differences: men are slightly more likely to have received a government fellowship and they are more likely to have served as a TA rather than as a research assistant while in graduate school as shown in Figure 2. Few men or women relied exclusively on their own or spouse's earnings, although both sources of support were secondarily important for many students. Family contributions were almost neglibible. This lack of support from the family contrasts sharply with the role of the family

in financing professional school education in law, medicine, and dentistry in which the student's family is expected to continue paying tuition and living expenses; the family income is used to calculate eligibility for scholarships and loans. In graduate science departments fellowships and other forms of aid are given without regard to need, and consequently, the level of support received by most students is at least adequate for tuition and living expenses. For a few students, perhaps 5%, one of these minor sources of income was the major source of income, but such people were exceptional.

Although both men and women were equally likely to receive fellowship support; men were slightly more likely to receive fellowships from the federal government or from foundations. That is, men were slightly more likely to receive fellowship support from sources requiring a formal application, letters of support, etc. It would be very interesting to determine why this is so. Several possibilities come quickly to mind:

1. Women undergraduates are given less information or encouragement to apply for such fellowships--lack of counseling or attendance at a non-career oriented school.
2. Women students are not perceived as serious enough to warrant federally or privately sponsored fellowship support so that their applications are less strong--letters of recommendation may be less enthusiastic.
3. The fellowship granting agencies favor men.

It is worthwhile to remember that there are major differences in the quality of fellowship support. Outside fellowships--those obtained from the government or private foundations do not usually require that the student work on a particular project or even enroll in a specific

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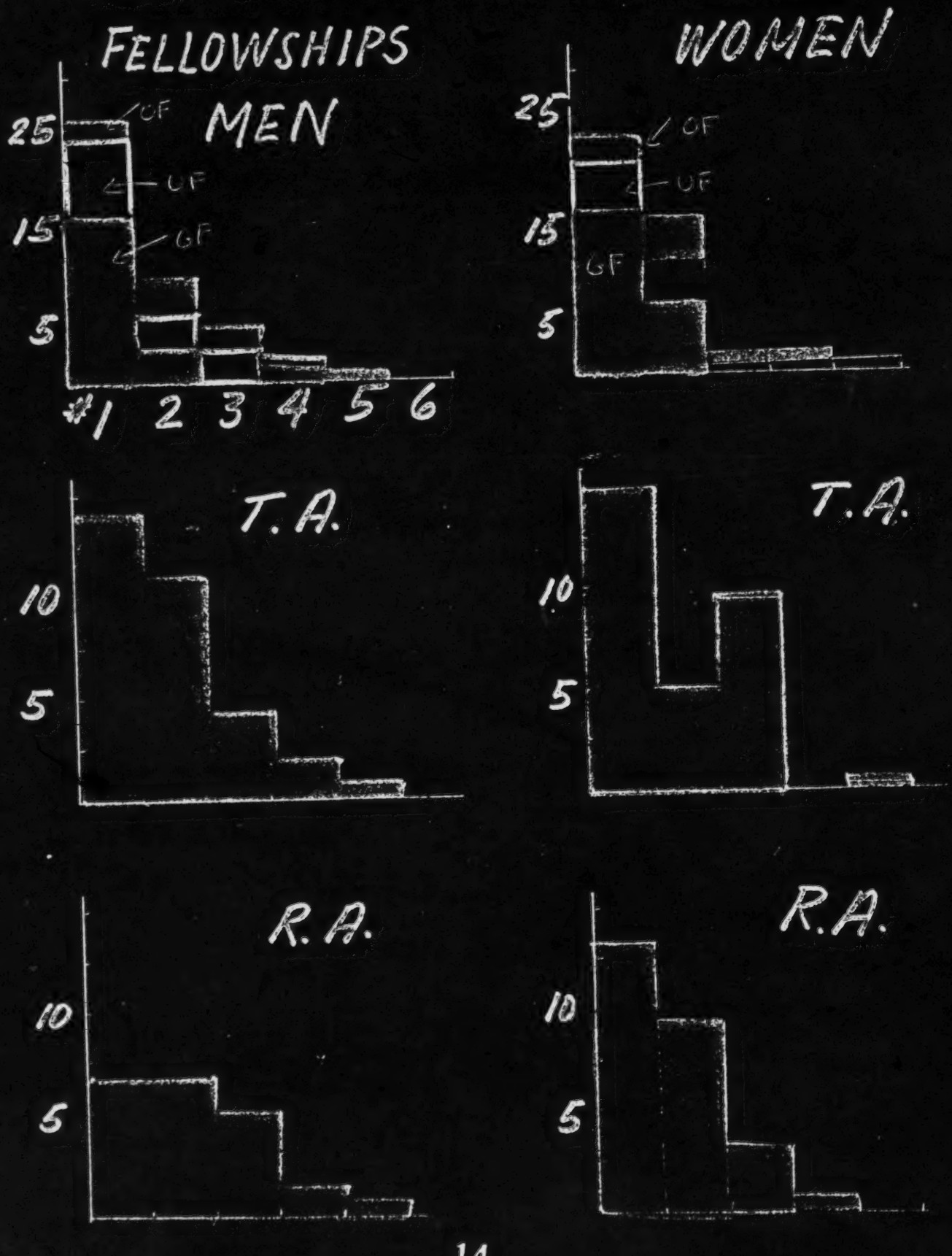
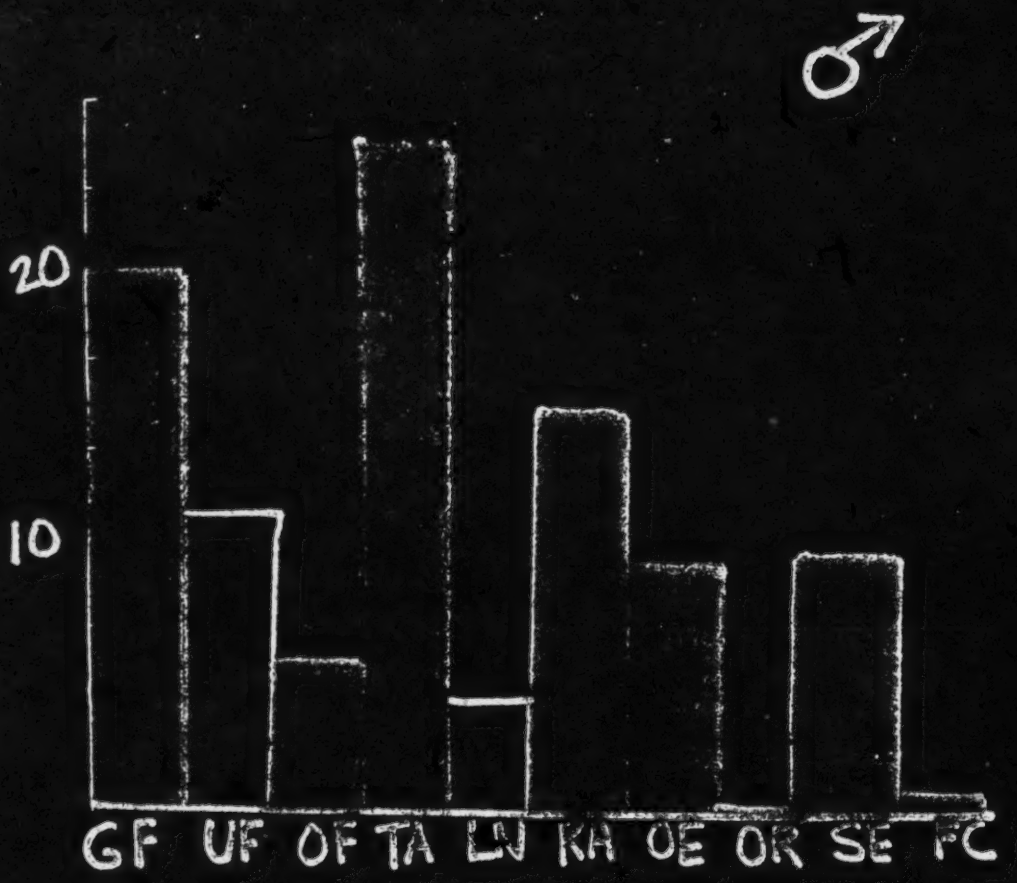


FIG. 1 in color



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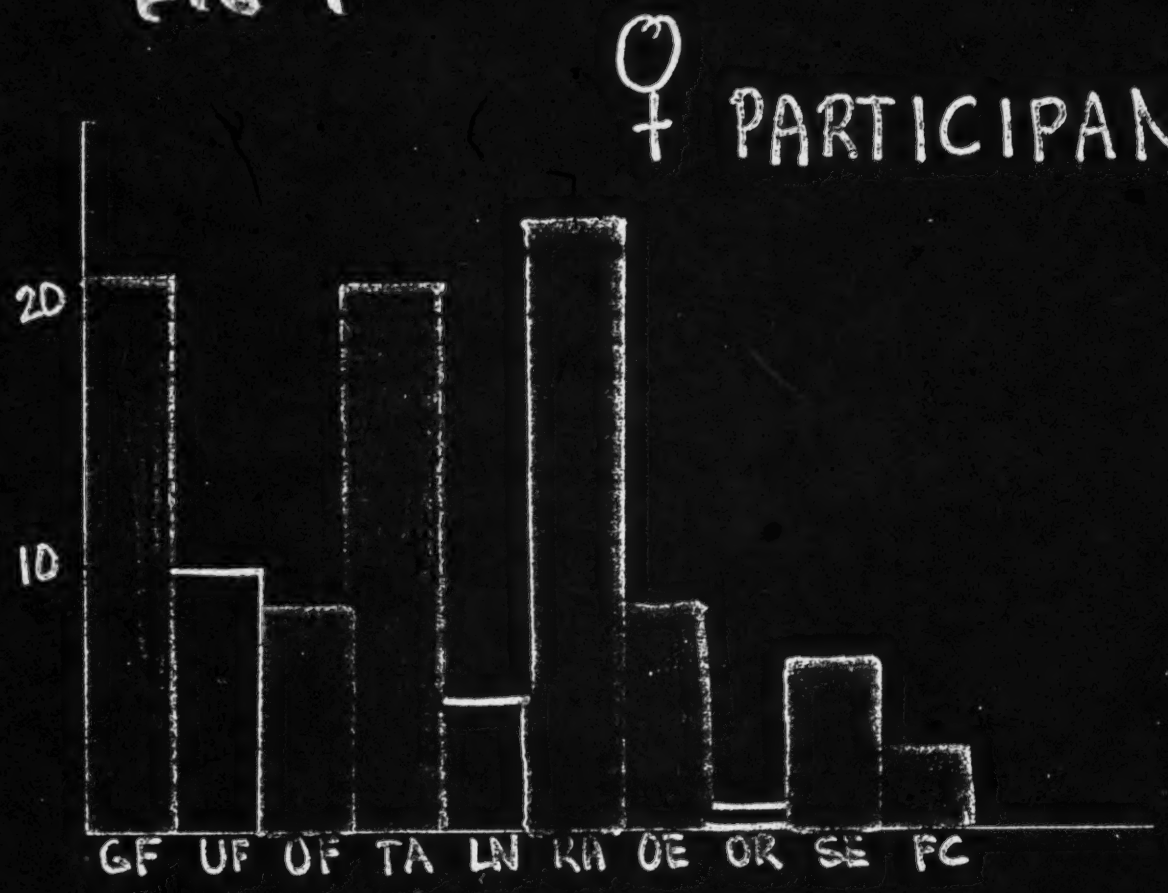

program. The student is given the maximum amount of freedom in choosing a department, an advisor, and a project. Summer income is also usually guaranteed since fellowships are typically of 12 months duration. The NSF fellowship program guarantees support for three years provided satisfactory progress is maintained toward the Ph.D.; consequently, NSF fellowship holders have three years of support with no strings attached. University fellowships are often considerably more restrictive, limiting students to 9 months support per year, specifying the Department and in some cases the advisor and project for the student. University and department-administrated fellowships are much more open to favoritism and unhealthy competition--often the competition is among the faculty members for fellowship support for their students rather than fellowship support awarded to students on the basis of merit.

After fellowships, teaching assistantships and research assistantships are the most common sources of support. Both of these financial aids entail considerable service from the student to retain the support: teaching assistants at large, public institutions may require 20-30 hours per week of work and research assistantships may range from a few hours per week to nearly full-time employment. The type of institution will have a great deal to do with the amount of work required of a student teaching or research assistant. For example, at some private institutions all biomedical graduate students are supported at current NIH training grant levels of $3900 for a 12 month year; teaching is required as part of the degree requirements for only a semester or two with about 10 hours per week typical. Contrast this with the requirements at many public institutions where teaching assistantships are awarded to

the majority of first and second year students for long hours each week, and the better students are recruited or even "captured" as research assistants by individual faculty members. A student with his own fellowship support would have a tremendous advantage at such a public institution--being relieved of teaching duties and the requirement to find a faculty advisor capable of supporting him--while all students at an elite private school receive the equivalent of private fellowship support. Students without summer support are often forced to work while better supported students do summer research projects, attend courses and field stations, and gain confidence in their careers. Fellowship supported students are often required to relinquish opportunities to earn outside monies--and they are expected to be and are treated as full-time students and beginning researchers. Students on ah hoc support and teaching assistantships are often forced to take outside jobs and are sometimes treated as an expendable part of the departmental staff.

Since graduate students in science are generally on their own and do not receive much support from their family or from loans to further their education, the importance of fellowships and other teaching or research assistantships is critical. The Conference on Women in Scientific Research noted financial support as a critical issue; any reduction in predoctoral support, they contend, will have a deleterious impact on the recruitment of minority and women students to science. The participants in the survey and conference were all people who had found sufficient resources to continue graduate education--another study will be required to determine precisely why people drop out of promising science careers. Lack of independent financial support

would surely be a major reason; financial independence is tied to other issues such as (1) does the student have sufficient time to pursue research, library work, and classes? (2) the beneficial impact to the student of national recognition of promise as a research person. (3) freedom from advisor's restrictions. The carryover at the graduate institution of the enhanced status of having a fellowship can be both subtle: such as being taken more seriously by the faculty or explicitly: students with fellowships often have first call on money to attend meetings and to receive tuition for field and experiment stations.

Special programs of financial support for women and minority students may be required to provide the best opportunity for success in fields with a low representation of women and minority persons. It is possible that students with their own fellowship support would be better able to overcome the feelings of "outsider"--a sentiment often expressed in the essays written by women in the physical sciences--if strong fellowship support were guaranteed. Certainly the faculty, upon accepting such a student, would tacitly agree that the student will finish and that they must realistically deal with the student's research needs. A tuition rebatement, supply allowance, or other institutional inducement to recruit students with guaranteed fellowship support might also be required. Now, for example, there is hot competition to recruit students with their own NSF fellowships since the net savings to the budget unit in which the student works is the fellowship plus tuition, about $9,000 per year at a private institution and $5,000 at a state supported institution. If fellowship support of a similar nature were targeted specifically for minority students, there would be a similar

competition to recruit academically qualified minority students by many graduate schools.

Much of what I have reported to you today is obvious to anyone who has considered the financial picture for graduate education. Students given adequate support and self-confidence are much more likely to succeed than those who must struggle for financial support and recognition as a colleague. These two problems (lack of financial and intellectual support) are those most often touted as the reasons few women and minority students enter graduate programs in science. Direct aid in the form of competitive fellowships for the target groups would solve at least part of the problem.

PERCEPTION OF FINANCIAL NEEDS

Another aspect of the analysis of the financing of graduate education was to examine the essays of the respondents for indications of worry and concern about their financial future. That is, to what extent did students worry about their finances during graduate school? Most science students are considerably better off financially than students in the arts and humanities, however, the sporadic nature of TA and RA support is still cause for concern.

About 40% of women responding mentioned financial need as a problem in graduate education; most women thought that financial support was an important problem in general and for specific groups of people such as married women whose husbands may be expected (unfairly) to pay for their education. Most women saw being a female as a disadvantage in getting financial aid.

Male respondents to the survey had an entirely different point of view. Men respondents thought that women had an advantage in getting financial aid in graduate school. They did not comment on the problem of husbands' being expected to contribute to graduate education, but most married men responded that it was their expectation and an expectation of society that women should support their husbands through graduate school. Several men listed being married as a distinct advantage during graduate school since their wife's income allowed the couple to live a "middle-class" rather than "student" life. Most men commenting on the problems encountered by working wives, mentioned that they felt guilty having to depend on their wife for financial aid while she forfeited chances to continue in school or had to attend only part-time.

In the personal essays written by each respondent, the concern with financial aid can be more clearly discerned in terms of personal crises. About one-half of the women respondents mentioned financial aid as a major concern at some point in their career: "If I hadn't gotten the scholarship I would have quit." Some women who had not had any personal problems mentioned financial aid in passing or stated that it was a problem other women might have. Financial aid concerns were secondary however, to other problems encountered by the women respondents in every case: women felt that self-confidence in their ability, marriage v. career, dealing with the faculty, or other career related problems were of greater importance than financial aid.

The relative non-importance of financial aid overall to the women in the survey contrasts sharply with the major emphasis given financial problems by male respondents. About 80% of the male respondents

dealt in great detail with their financial aid and finances during graduate school. For married men this discussion often dealt with their role of the family breadwinner; for most students however, the discussion was a saga of attempts to get more money and of the realization that a career in science was not lucrative. Not a single woman mentioned that scientists have low salaries as a disadvantage of a career in science while about 40% of male respondents explicitly listed low salary as a disadvantage of a scientific career.

From this brief overview of the information collected from the A.A.A.S. Conference on Women in Scientific Careers a few conclusions can be drawn regarding the financial considerations for undergraduate and graduate education in science.

At the undergraduate level most students depend on their family, their own earnings and scholarship support. The federal government plays no direct role--as perceived by the student--in furthering their education in science. The only exception may be the student loan programs which in some cases are restricted to students pursuing careers in science or technically related fields. However, the federal government has done little to specifically foster science education opportunities for the typical undergraduate student. For highly motivated--partly self-selected and partly chosen by the faculty students from research institutions--NSF sponsored research opportunities and summer workshops are an important and direct involvement of the federal government in encouraging students to pursue careers in science. Such programs are available to only a few students, and with the increasing cost of college education and increase in student earnings expected to

finance education, such research programs may be unsuccessful in reaching most students unless the financial support for student stipends is considerably increased. Government sponsored work-study programs often provide students with academic year jobs in science departments. However, the work study program does not guarantee meaningful exposure to scientific research as most students at many institutions become "free" dishwashers and perform other menial labor for laboratories without learning much but the drudgery of science.

The dramatic intervention of the federal government at the graduate level has created a caste system among graduate students in which the most favored are further groomed for success by garnering a government sponsored fellowship; such a fellowship allows the student sufficient time to pursue studies and research full-time while classmates serving as T.A. and R.A.'s struggle. This struggle did not seem to deter the survey participants; however, the male respondents were angry that they had not received a paid trip through graduate school and the female respondents, on the other hand, were thankful to have made it through graduate school at all. Increased and directed financial support for women and minority students might both increase their numbers in graduate science departments but also increase the self-esteem and value of the individuals holding such fellowship monies. Being in control of your own financial future would allow more freedom to students who felt trapped as T.A.s or R.A.s and would allow the student plenty of time to choose a project and advisor well suited to their research and psychological requirements.